

EXTREME WAVE RUNUP OVER THE STEEP ROCKY CLIFFS OF
BANNEG ISLAND, FRANCE

Guillaume Dodet¹, Fabien Leckler², Serge Suanez¹, Fabrice Ardhuin³

¹ LETG-Brest Géomer UMR 6554 CNRS, Institut Universitaire Européen de la Mer, Plouzané,
France, guillaume.dodet@univ-brest.fr, +33 2 98498691

² Service Hydrographique et Océanographique de la Marine, Brest, France

³ Ifremer, Laboratoire de Physique des Océans, UMR 6523, CNRS-Ifremer-UBO-IRD, Brest, France

Abstract

Ocean waves are constantly shaping coastal morphology. When storm waves are combined with high water levels, the wave runup can reach unexpected elevations and become a threat for coastal populations, through dike overtopping, dune breaching or accelerated coastline erosion. Therefore, the wave runup has been largely investigated over the last decades for its key importance in coastal engineering and risk management. Although the strongly nonlinear nature of swash flows prevented theoreticians and modellers from accurately predicting its kinematics, numerous laboratory and field studies provided a means for establishing wave runup empirical formula, which are now commonly used in engineering practice. However, most of the field studies only concerned gently sloping sand beaches, and run-up formula have barely been validated against field observations in steep rocky environments, where data are still very sparse. This study presents water elevation data acquired with pressure sensors solidly fixed to the bedrock of Banneg Island, France, during winter 2013/14. Offshore wave parameters and water levels were also measured during this winter and recorded storm events with H_{m0} up to 9 m in spring tide conditions, which caused flooding and boulder transports across the island. A methodology to infer $R_{2\%}$ from the local pressure measurements was implemented. The 4-month time-series of run-up measurements at the top and at the bottom of subvertical cliff profiles (with slopes ranging from 20% to 30%) were compared with offshore wave parameters and revealed a strong dependence of $R_{2\%}$ to the Hunt parameter ($\xi \cdot H_{m0}$). Several period parameters based on the spectral moments were also tested to compute ξ and the best correlations were obtained with $T(m0,-1)$. Finally, the exceptional run-up values (up to 8 m) measured at the cliff top during the major storms allowed to test the validity of existing run-up formula for a range of conditions that exceeds any other observations, to our knowledge.